NOMINALIZATIONS IN SCIENTIFIC AND POLITICAL GENRES: A SYSTEMIC FUNCTIONAL LINGUISTICS PERSPECTIVE

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ABSTRACT

Language, science and politics go together and learning these genres is to learn a language created for codifying, extending and conveying scientific and political knowledge. Grammatical metaphor is divided into two broad areas: ideational and interpersonal. This article focuses on the first type of grammatical metaphor, i.e. the ideational one, which includes process types and nominalization. The principal objective of the current work is to analyze a corpus comprising 10 scientific and 10 political texts. The Ideational Grammatical Metaphor framework was used to carry out an analysis on these texts to pinpoint their similarities and dissimilarities. The analysis indicates that Ideational Grammatical Metaphor has dominated political and scientific texts and is used approximately with the same frequency in both genres and the prevailing process types in both are material and relational types. Consequently, the tone of the writing is more abstract, pretentious and formal. In science, instances of IGM enable technicalizing and rationalizing; and in politics they deal with dominance, provocation, persuasion toward an intended objective. Based on the findings of this study, some implications can be drawn for academic writing and reading as well as translators and teachers involved in writing and reading pedagogy.

KEYWORDS: Ideational Grammatical Metaphor, Nominalization, Process Types

INTRODUCTION

Developed mainly by Halliday (1985,1994), Grammatical Metaphor (GM) is "a substitution of one grammatical class, or one grammatical structure, by another" (Halliday & Martin, 1993, p. 97). GM is conceived "as an incongruent realization of a given semantic configuration in the lexico-grammar" (Halliday, 1985, p. 321). Halliday and Matthiessen (1999) maintain that GM has its unique performance characteristics as a kind of grammar phenomenon.

Halliday (1985, 1994) classified GM into ideational and interpersonal metaphor, in which the Ideational Gramatical Metaphor (IGM) includes process and nominalization. IGM is a non-metaphorical depiction of the ideational meaning. It is principally symbolized by the transitivity system. IGM primarily utilizes the form of the noun to convey the process or quality which should be expressed by verbs and adjectives.

Nominalization is the most typical structure of IGM, particularly in scientific, political discourse etc. Halliday and Matthiessen (2004) point out that information density, nominalization and GM are as the foremost lexico-grammatical features of the academic and written language. They also state that nominalization has been recognized as the sole most substantial resource for establishing GMs. In short, the major reflection of the IGM is nominalization, for instance, *trains head-on collision* is a metaphorical variant of *trains collided head-on* in which the process *collide* is rendered in a nominal type of construction. In the English transitivity system, there are six main types of process: material, relational, mental, verbal, behavioral and existential processes.

REVIEW OF LITERATURE

Taverniers (2002, 2003) asserts that the concept of realization and especially the inter-stratal coding relationship between semantics and lexico-grammar play a remarkable role in the recognition and understanding of GM as a specific phenomenon of language. The notion of GM represents an original and innovative contribution that identifies and describes the fact that all genres, in particular, political, scientific and academic registers in writing and in speaking, are practically directed to achieving *objectification* and *abstraction* of their content. They accomplish this functional objective through the linguistic process of GM, a procedure that encapsulates information by conveying experiences and events in a metaphorical mannar, as opposed to the more typical congruent form that prevails in everyday language use.

A previuos study has reported that (Thompson, 2004) the possibility of re-setting the relationships between meanings and wordings, which is a crucial resource for enlarging the meaning potential of language, is known as GM. When we analyze texts, particularly in transitivity, we are likely to run up against problems in deciding how best to code certain wordings: the transitivity labels, that seem most easily applicable, do not seem to capture all the meanings. These problems arise for a number of reasons; but one of the most common sources of difficulty is GM.

In IGM, lexico-grammatical characteristics are re-organized to put forth a definite perspective of reality. One sort of a clause is revealed as another type and the processes and qualities are construed as if they were entities, through the process of nominalization. By nominalization, processes and properties are reworded metaphorically as nouns; instead of functioning in the clause, a process or attributor functions as thing in the nominal group (Halliday, 1985, 1994).

Thus, nominalization refers to the utilization of a verb or an adjective into a noun, with or without morphological conversion, so that the word can now function as the head of a noun phrase. In English, some verbs and adjectives can be applied directly as nouns, for instance, *protest* and *nice*, while others inquire some form of morphological alternation demanding a suffix, for example, *nominalization* from *nominalize; discrimination* from *discriminate; difference* from *different;* and so on. When a verb is nominalised, it becomes concept rather than an action (Webster, 2002, 2003).

According to Thompson (2004) and Eggins (1994), one important function of nominalization is *condensation.* Collective texts typically initiate new meanings in the form of clauses, since clauses are negotiable, they present claims by the writer that the reader can reject. Once a meaning has been introduced in this way and has been accepted, it can then be used as a basis for the next step in the argument. Nominal groups have two qualities: First**,** a noun typically refers to a *thing*, that is, something that exists. By *nouning* a process, writers can mirror the fact that they have discussed and created the meaning of clause concentrated on the process-in other words, that meaning can now be handled as having existence. Second, the nominalization is itself accessible to act as a participant in another process. It can also function as Theme. One reason why nominalization is in accord with the ideology of scientific, academic, and formal writing in general, is that it makes it easy for processes to be objectified- to be transmitted without the human doer. Consider the following examples by Eggins (1994, p.57):

1. **a.** I submitted my essay in late, because my kids got sick (**Congruent**).

   b. The reason for the late *submission* of my essay was the *illness* of my children (**GM**).

It can be said that the same content, the same set of actions and events in the real world get connected with two very various linguistic forms according to whether we are speaking or writing. The sentences (2.1. b) displays that the

message has somehow been condensed to fit into only one clause. Thus, nominalization conceptualizes and objectifies the process or action and also, it decreases the number of clauses and more information is compacted into each nominal group. Each metaphorical domain has its congruent realm (Kazemian, Behnam & Ghafoori, 2013). Metaphorical domain explicates the situation more intriguing, academic and formally as compared with the congruent one.

Halliday (1985, 1994) contemplates that there are two kinds of utterances: *congruent*, also called non-metaphorical; and incongruent, or metaphorical. Predominantly, it is believed that people, places and things are realized by means of a noun; actions are realized verbally and so on. However, all meanings may have more than one way of realization, and sometimes, in written language and particularly in scientific register, the realizations of the semantic functions of the clause are not typical, but marked. The general characterization of GM in terms of alternative realizations is stated more precisely as alternative lexico-grammatical realizations of a choice in the semantics (Simon-Vandenbergen, Taverniers, & Ravelli, 2003).

Halliday (1994), Simon-Vandenbergen et al. (2003) and Taverniers (2006) maintain that traditionally metaphor is viewed as variation in the use of words, i.e. variation in meanings and hence the consequence of lexical or lexico-semantic processes. This is a view *from below*, regarding the words as starting point and then expressing something about the meanings these words realize. Metaphor is, however, employed in SFL in a relatively new sense to refer not to *the variation in the use of words* with a conveyed meaning but to *variation in the expression of meaning* (Halliday, 1985, 1994). Unlike the former view, this one is a view *from above* where the starting point is a particular meaning and the relevant question is how it can be demonstrated or realized. Considering this from *above view*, it is conceded that metaphorical domain is lexico-grammatical rather than exclusively lexical, and that lexical choice is just one aspect of lexico-grammatical preference or wording; the other facet is grammatical. The two alternative views are represented in Table 1 adopted from Simon-Vandenbergen et al. (2003, p. 7):

Table 1: Two Perspectives on Metaphor: From above and below
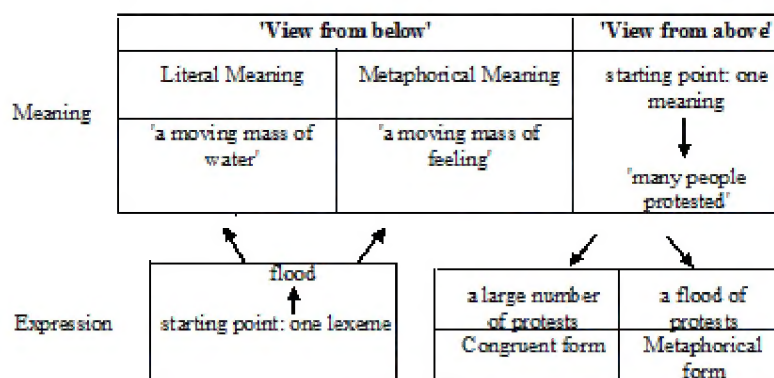
To justify the need for a new and complementary interpretation of the term metaphor, Halliday (1994) provides the following instance:

the expression *protests flooded in* can be realized as *protests came in in large quantities*, *protests were received in large quantities* or *very many people protested*. In none of these is the variation purely lexical; there is also a difference in the grammatical configuration: in *protests came in in large quantities*, a prepositional phrase is added; in *very many people protested* the noun *protest* is now represented by a verb (p. 342).

This brings Halliday to GM, and in fact, convinces him to claim that grammatical variation does even play a more important role than lexical variation in the expression and realization of meanings. Transitivity choices involve selections from various *process types* that are realized in *verbal groups*; the associated participant roles are realized in nominal groups and the circumstances are realized in either prepositional phrases or adverbial groups as follows (Kazemian *et al*., 2013). Process types may be material (2.2. a), mental (2.2. b), behavioral (2.2. c), verbal (2.2. d), relational (2.2. e) or existential (2.2. f) as follows adopted from Kazemian *et al*. (2013):

2. **a.** *They vandalized telephone booths in the street.*

    b. *Just imagine life without water.*

    c. *He breathed deeply to blow off steam.*

    d. *Read the poem by heart..*

    e. *Tabriz is famous for its scenic views and sightseeing.*

    f. *There are some lurking behind the bushes.*

Halliday (1985, 1994) views **transitivity** as an ideational feature which serves to linguistically construct the goings-on of the real world. According to his theory of SFL, transitivity configures linguistic elements to represent inner and outer experiences of the world. Halliday (1994) explains: "Our most powerful conception of reality is that it consists of *goings-on*: of doing, happening, feeling and being. …. The transitivity system construes the world of experience into a manageable set of PROCESS TYPES" (p. 106).

Table 2: Process Types in English from Martin, Matthiessen, & Painter (1997, p. 228)

Process Types	Category Meanings	Example
Material Action Event	'doing' 'doing' 'happening'	*The police dispersed the crowd.* *The army shelled the innocent civilians.*
Behavioral	'behaving'	*She wept for the loss of her mother..*
Mental: Perception Affection Cognition	'feeling' 'sensing' 'emotive' 'thinking'	*I heard a noise outside.* *The girl loved her mother..* *Just visualize his reaction.*
Verbal	'saying'	*He described the procedure.*
Relational Attribution Identification	'being' 'attributing' 'identifying'	*Those apples are rotten.* *Tabrix is the center of Azerbaijan.*
Existential	'existing'	*Maybe there's some other darker pattern.*

The above table represents the process types and their category meanings with some instances in English.

The predominant lexico-grammatical feature in all academic writing, in particular, in political and scientific texts of the study is the extensive and elaborate use of the nominal group, represented by nominalization. Every sentence of a written text contains some lexical and some grammatical components that form its existence as a meaningful context. This meaningful context contains grammatical shifts or GM, especially in the IGM where these meaningful changes are obvious. Knowing how to use GM in academic registers is an underlying part of developing academic language. Realizing the similarities and differences between English and other languages can help bilingual students, translators to

transfer these features from one language into the other. Besides, many times, students relate metaphor to the lexical domain of language and literature and don't know the influential role of metaphor in a grammatical sense. Secondly, students think that there is only one way to convey their intended meanings, as a reason they express their meaning in informal and simple ways (Kazemian et al., 2013). It is hoped that identifying and comparing IGM in political and scientific texts raise students' awareness regarding the role and function of GM in written text and help them to know different ways of expressing the same meaning and convey their meanings in a more intriguing, persuasive, bright and vivid way.

Political and scientific texts have always been an interesting area for analysis and discussion, especially in terms of GM. The reason for choosing scientific texts is that, as Halliday & Webster (2009) argued, nominalization in all probability developed first in scientific and technical genres and then gradually extended and spread to other realms of adult utterances and turned into a mark of prestige and power. GM has been of great significance in the development and expansion of scientific writing, especially in the form of nominalised expressions. And the reason for selecting political texts is the elaborate use of GM by politicians and political writers to provoke and persuade the audience and reader and/or dominate them. It is also worth mentioning that to date there are few comparative studies related to GM and IGM and none to compare political and scientific texts, and nearly all of the studies have exclusively investigated one genre, and if there are any, they have confined themselves to a small number of texts. Comparatively speaking, this study is the first one investigating IGM in political and scientific texts with a large number of texts.

Research Questions and Hypotheses

Based on the main purpose of the research and the scope of the study, the researcher would try to find logical answers to the following research questions.

- Are there any similarities between political and scientific texts in terms of IGM embodied in them?

- Are there any dissimilarities between political and scientific texts in terms of IGM embodied in them?

- If such similarities and differences exist, how are they realized in terms of process types?

  And the following hypotheses, accordingly, were formulated,

- There are similarities between scientific and political texts in terms of IGM.

- There are discrepancies between scientific and political texts in terms of IGM.

METHODOLOGY

Corpus

Due to the primary importance of selecting authentic and genuine texts in political and scientific discourses, a struggle was made to select political texts from various sources such as *Time Magazine* (2007), *Political insight* (2012) and some on-line magazines titled *Global affairs* (2008, 2009). Scientific texts are also selected from different sources such as some on-line magazines titled *Atlantis Rising Magazine* (2012), *Penn State Ag Science* (2010, 2011), *Penn State Agriculture Magazine* (2008), *and Scientific American* Magazine (2012).

Due to time limitation, 10 scientific and 10 political texts, approximately 6120 words of each genre, were utilized as the corpus in order to identify and analyze the frequency of nominalization and process types for each nominalized

word, and also to compare and contrast them to find similarities and discrepancies between two genres in terms of IGM. It should be pointed out that all chosen texts from the above mentioned references amount to approximately the same numbers. This study is a comparative one and both texts should comprise the same number of words to be inquired into properly. Thus, it is the same number of words that functions as our benchmark and can able the researchers to say, for instance, how many instances of GM are applied and which process type is prevailing in either of the genres.

Procedure

In order to compare and contrast possible similarities and dissimilarities and also to find metaphorical and congruent expressions as well as process types, in these 20 texts, it was essential to choose a model or models to analyze the data. Therefore, Halliday & Matthiessen's (1999), Martin et al's. (1997) and Simon-Vandenbergen et al's (2003) views and approach as the most inclusive ones were used as the main theoretical basis of the present research. As formerly mentioned, processes are essential to transitivity. They center on the part of the clause which is realized by the verbal group; and by nominalization, processes (verbs) and properties (adjectives) are reworded metaphorically as entities (nouns). Processes can be subdivided into different types (see Table 2). According to Halliday (1994), each metaphorical expression must have its counterpart congruent wording. So, in this research not only process types but also congruent domains of extracted IGM instances were discussed. To pinpoint the instances of IGM in political and scientific texts, the researchers read the texts with pinpoint accuracy and identified IGMs. It was observed that nominalization is the most prevailing components of both scientific and political texts that results in IGM. After extracting IGMs, an attempt was made to express metaphorical domain in congruent domain since illuminating both the congruent and non-congruent realms lead us to fully comprehend the notion of transitivity system.

It is worthwhile to bear in mind that rendering metaphorical expressions in congruent forms are based on inventories illustrated by Simon-Vandenbergen *et al.* (2003), Halliday & Matthiessen (1999), and Martin *et al.* (1997). If metaphorical and congruent expressions are juxtaposed, it will demonstrate that in most of the cases both of them tend to explicate the same situation, but the metaphorical domain spells out the state of affairs in a more condensed, intriguing, impressive and concise way and of course in a little complex and implicit manner. Since a link between IGM and transitivity system is inseparable which allows us to construe the world of our experience into a limited set of process types, an effort was made to pinpoint process types in all the extracted and rendered IGM instances. Due to the frequent utilization of some incongruent words, the frequency of each metaphorical word in each text was scored separately. Tables were depicted based on metaphorical and congruent expressions, a certain type of process as well as frequency and percentage of process types in per text.

Design

The design of the present study was descriptive-analytic which centered on the frequency of instances of IGM and their congruent wording in scientific and political texts. As a framework of analysis, Hallidyan SFL's model of text analysis on GM is used as a benchmark to analyze the rendered metaphorical expressions based on the process types of clauses.

DATA ANALYSIS

Introduction

The analysis of the texts was carried out to spot how many instances of IGM are utilized in them and what the

respective frequencies are. In addition, the data has been inquired into to find out the role and function of IGM in these texts based on process types. In order to avert confusion while reading the article, it should be pointed out that samples of five political texts are depicted in table 3, and the rest are in table four of the study. This ordering is true for political texts as well, i.e., instances of five scientific texts are in table 5 and the others are in table 6.

IGM in Political Texts

In reviewing the literature, it is mentioned that the principal purpose of nominalization is condensation, which can make more information included in fewer clauses. The feature just corresponds to the fact that the clause and texts use fewer and unpacked words in sentences to express more messages. Moreover, It is considered that the grammatical simplification is concurrently linked with the lexical density, referring to the fact that the fewer clauses are going to accommodate the lexical items. Nominalization boosts information density and enhances the content of utterances through rendering a sentence or sentences in a noun or noun phrases (Halliday & Matthiessen, 1999; Kazemian *et al.*, 2013).

In political texts, lexis and grammar are re-arranged in a clever way in order to provoke and invite a majority of people into certain states of political action. It is suggested that the authors of such discourse are deliberate in using GM for reasons which might include making everyday experience inaccessible and remote (Halliday & Matthiessen, 1999; Woods, 2006). Due to efficiency and convenience of being able to compact large amounts of information into a single word, nominalization is a widely exploited linguistic technique in news, scientific and political discourses. The following table represents IGMs in political texts:

Table 3: Samples of IGMs in Political Texts

No.	Metaphorical Wording	Congruent Wording	Process Type	Frequency in per Text
1	urban disorder	the urban area was disordered	material	8
2	cause shock	people were shocked by	mental	1
3	he examines the riot	he examines why people have rioted against.	material	8
4	and a demonstration at the police station	and people demonstrated at the police station	material	1
5	strident demand	to demand something stridently	verbal	1
6	Queen's coronation	and the queen was crowned	material	2
7	constituency over the issue	to be constituent over.	relational	1
8	immigration to the UK	people have immigrated to the UK	material	1
9	development of the international organization	to develop international organization	material	1
10	a dedication to goals of social	to be dedicated to goals of social	relational	1
11	UK's ongoing constitutional turbulence	UK's ongoing constitutional is turbulent	relational	1
12	the continued use of	to use continuously	material	1
13	the simultaneous growth of	to grow simultaneously	material	1
14	the intense frustrations	to be intensively frustrated	behavioral	1
15	in explanation	to explain it	verbal	1
16	the Hakim delegation	someone was delegated by Hakim	material	1
17	He has a real presence	he is really present	relational	1
18	an agreement to keep meeting	they agreed to keep meeting	verbal	2
19	battles between the Sadr and Hakim forces	the Sadr and Hakim forces battled together	material	1

IGM instances in Table 3 indicate that nominalization is frequently utilized in these five texts of the study.

Out of 307 IGMs in these texts, 187 are material, 82 relational, 16 mental, 17 verbal and 4 are behavioral processes and 1 is an existential process.

Woods (2006, p. 73) argued that nominalization in political texts has "the effect of making the second expression sound more *impersonal* or *remote* than the first"; our attention is diverted from the process that is actually happening and directed instead to the product of the process. Discourse analysist would say that "the process is backgrounded and the effects foregrounded" (p. 73). Notice the device of nominalization used by Tony Blair when he speaks about *change* adopted from Woods (2006, p 73):

3. We are simply being tested by the force of *change*. The pace of *change* can either overtake us, or make our lives

   better and our country stronger. So what is the *challenge*? It is that *change* is marching on again.

Change and *challenge* here are the nominalizations; they have the syntactic forms of the noun, and the force of these forms divert our attention from such question as: *What is changing*? *Why is it changing*? Woods also adds that some words on the language of politicians are metaphorized in a manner that suggests they are inevitable and inescapable. A similar concealment can also be achieved by the use of a kind of syntactic metaphorizing, and particularly by means of nominalization (Woods, 2006).

In revising literature, several studies (Eggins, 1994; Halliday, 1985, 1994; Taverniers, 2003, 2004, 2006) have analyzed and revealed one or some distinguished properties of nominalization by fits and starts, but Wang (2011) and Kazemian *et al*. (2013) have investigated and classified nearlly all characteristics of nominalization in details in the following way in which it has six features and also most of these characteristics are apparent in all the extracted nominalized expressions in political and scientific texts of this study as follows:

1. Nominalization makes actions or processes (verbs) become concepts (nouns).

   4. **a.** Pennington's eight-month *tour* in Iraq in 2006 earned her the Bronze Star (Kennedy, 2007). (**GM**)

      b. Pennington *toured* for eight month in Iraq in 2006 and it earned her the Bronze Star (**Congruent**).

In the above examples, when a verb is nominalised, it becomes a concept rather than an action. As a consequence, the tone of the writing sounds more abstract and also more formal.

2. With nominalization, a single sentence packs in several complex abstract ideas.

   5. **a.** The situation in Iraq worsened, and his key domestic *proposals* social *security* and *immigration reform*—flopped (Klein, 2007) (**GM**)

      b. The situation in Iraq worsened, and he has *proposed* some domestic key points about society which is *secure* and to *reform* the law that how people can *immigrate*—flopped. (**Congruent**)

By comparing the above two sentences, we can see that several complex abstract ideas are packed into one single sentence or two.

3. Nominalization builds long noun phrases to produce a lexically dense style as follows:

   6. **a.** the *award* honors women who have changed the state and nation with their *courage*, *strength* and *wisdom* (Kennedy, 2007). (**GM**)

b. Honorable women are *awarded* and they are those who have changed the state and nation and are *courageous*, *strong* and *wise* (**Congruent**).

Table 4: Samples of IGMs in Political Texts

No.	Metaphorical Wording	Congruent Wording	Process Type	Frequency in per Text
1	presidential debate	to debate to be a president	verbal	3
2	social security	to be socially secure	relational	1
3	The Democrats' takeover of both houses	The Democrats take both houses over	material	1
4	we've seen progress	we have progressed and seen it	material	1
5	slaughter in Darfur	people are slaughtered in …	material	2
6	interference from Darfur neighbors	neighbors of Darfur interfere in/ with	material	3
7	The gross negligence of certain regions	certain regions were grossly neglected/negligent by	mental	1
8	The real fear threatening Sudan	the real problem that threatens and fears Sudanese is	mental / verbal	1 / 1
9	at an election rally	people had rallied to elect someone as a …	material / material	1 / 3
10	change we can believe in	we can change and we believe in it	material	2
11	small donations on the internet	people donated a small amount on the internet	material	1
12	the anniversary of North Korea's founding on September 9th	the anniversary of North Korea which was founded on …	material	1
13	by the death of Kim Jong II	when Kim Jong II died	material	2
14	the gossip over the Democratic …	people were gossiping about …	verbal	1
15	to endorse his candidacy	to endorse that he is a candidate	relational	1
16	the return to Pakistan	she returned to Pakistan	material	1
17	capable of charming the Western	is capable to charm the …	mental	1
18	for unity	to be united	relational	1
19	media attention	the media is attentive	relational	1

As it is apparent from Table 4, IGM continues to permeate in every part of the political texts. In these texts (see secondary sources), there are 249 IGMs in which 148 go for material, 60 for relational, 13 for mental, 22 for verbal, none for behavioral and 6 for existential. Here it is the role of GM that condenses the sentence and not only does it add to the beauty of the clause and graces the texts but also it assissts the politicians and political text writers to convey their message in a more interesting and persuasive way.

4. Nominalization lessens the number of clauses and more information is compacted into each nominal group.

    7.   **a.** Benazir's *assassination* at a *campaign rally* has had ripples around the world (Herekar, 2008). (**GM**)

        b. Banazir was *assassinated* when people had *rallied* and *campaigned* for her and it has had ripples around the world. (**Congruent**)

The congruent sentence (4.2.5 b) has four clauses while the nominalised sentence has only two. Thus the writer is able to encapsulate more information into per nominal group.

5. By nominalizing the processes, they become concepts rather than actions; consequently, the amount and information density to make more comments or observation about the concept in the sentence are doubled or tripled, for example:

    8.   **a.** Kim Jong II had suffered a stroke in September; *speculation* has abound as to the *health* of the reclusive dictator (Pryce, 2009). (**GM**)

b. Kim Jong II had suffered a stroke in September; people have *speculated* more about whether the reclusive dictator is *healthy* or not. (**Congruent**)

In the above examples, the verb is nominalised in the first sentence; therefore the writer can add more information commenting upon the newly formed concept. A survey conducted by Knowles and Moon (2006) has shown that, ideologically, nominalization allows the writer or speaker to avoid mentioning the agent or doer of the action.

6. Eventually, nominalization enables an academic writer to concisely refer to recurring abstract ideas.

The main reason that causes politicians and political text writers to resort to IGM is that they tend to convey their message in a more convincing and powerful way and also to generate particular influence on the reader and audience. As it is indicated in all above tables and examples, these ten texts are replete with instances of IGM. Without IGM, political texts are incomplete and deficient to some extent and political texts writers can't produce certain effects, provoke and convince a majority of people into certain political outlooks and worldviews. The function of IGM is vital here in convincing people and capturing the minds of the audience. The success of political texts somehow relies heavily on the GM.

IGM in Scientific Texts

Halliday & Martin (1993) investigated and analyzed scientific discourse and concluded that it is commonly known that complexity in scientific language is achieved mainly through specific terminology and nominalization, which is part of GM. Scientific discourse is thus a functional variation of language with its own technical terminology and grammar. Unlike the language of everyday spontaneous speech, scientific language is functional for construing special realms of scientific knowledge and beliefs. As such, it embodies a unique worldview and way of thinking and reasoning (Halliday & Martin 1993).

It should become evident by now that scientific writing has a particular preference for nouns, especially the extended and nominalized ones. According to Halliday and Martin (1993), the evolution of scientific language has been one that foregrounds participants and backgrounds actions and processes.

To recognize the distinguishing properties scientific English owns and what functions they have in the discourse, Simon-Vandenbergen et al. (2003) believe that although technical terms are part of this overall effect, the complexity lies more with the grammar than with the vocabulary. The difficulty with technical jargon usually occurs not from the technical terms themselves but from the intricate relationship they have with one another. Halliday and Martin (1993, as cited in Kazemian et al. 2013) suggested seven headings which can be utilized for elaborating the features of scientific English: (1) Interlocking Definitions, (2) Technical Taxonomies, (3) Special Expressions, (4) Lexical Density, (5) Syntactic Ambiguity, (6) Grammatical Metaphor (GM), (7) Semantic Discontinuity:

In scientific writing, the *lexical density* (4) may go much higher and the language seems complex because it entails a large number of inter-relating technical jargon and each of which has been described and includes information the reader is expected to already comprehend. Among these features, Halliday and Martin (1993, as cited in Kazemian *et al*. 2013) regard GM more significant because they state that the items (4) and (5), mentioned above, are both by-products of GM. Moreover, Simon-Vandenbergen et al. (2003) stated that GM in scientific texts enables *technicalizing* and *rationalizing* and theses processes are dependent on the clausal to nominal shift which most strongly characterizes

GM. Technicality by itself would be of little value unless accompanied by a discourse of reasoning. The following table represents IGMs in scientific texts:

Table 5: Samples of IGMs in Scientific Texts

No.	Metaphorical Wording	Congruent Wording	Process Type	Frequency in per Text
1	for orchid fungi abundance	for orchid fungi which is abundant	relational	1
2	to environmental changes	when the environment is changing	material	1
3	could support germination	could support them to germinate	material	1
4	have no fruiting structures	they are not structured to fruit	material material	1 1
5	promote growth in each orchid	each orchid will be promoted to grow more	material	1
6	mysterious activity	to act mysteriously	material	1
7	it adjusts the cadence of breathing to …	it adjusts the cadency when we breathe based on …	relational	1
8	have the voluntary ability	are voluntarily able to	relational	2
9	before muscular exertion	before it exerts our muscles	material	1
10	hyperventilating his lungs	he hyperventilates his …	behavioral	1
11	and inventing the calculus	and when he invented the …	material	1
12	accumulation view of science	to accumulate and view science	material mental	1 1
13	what makes a scientist is ignorance	scientist is ignorant/ ignores	mental	7
14	every new discovery	every new thing which is discovered	material	2
15	come as something of a relief	come as something to relieve you	mental	1
16	growing pains	she is painful and it grows	material relational	1 2
17	disease control and prevention	which controls and prevents disease	material material	2 1
18	128,000 hospitalizations	128,000 people were hospitalized	material	1
19	with absolute certainty	to be absolutely certain	relational	1

Out of 291 nominalizations in these texts, 134 are material, 88 are relational, 26 are mental, 24 are verbal, 15 are behavioral and 4 are existential processes. By comparing the congruent and metaphoric versions in above instances, it implies that unpacking a text often involves re-inserting human actors, often rendered unnecessary by nominalization. The ability of nominalization to condense meanings is also clearly shown, when we simply compare the length of the original nominalized text with the length of the unpacked version. Significantly, this unpacked version has lost much of its prestigious sound (Eggins, 1994).

Nominalization can increase the information load of the nominal group, and it succeeds in condensing the information of the clause. Nominalization enables any comments, or remarks, to be restated in a precis and compact form –packed, as it were, and encapsulated by means of grammar– so that it functions as the starting point for a further stage in the rationality (Simon-Vandenbergen et al., 2003). In most examples, all the properties of scientific texts such as lexical density, syntactic ambiguity, GM, technicality and rationality are apparent. The more GMs in the text, the fewer processes, and consequently, the more information load and lexical density will be (Simon-Vandenbergen et al., 2003). The following table also represents IGMs in scientific texts:

Table 6: Samples of IGMs in Scientific Texts

No.	Metaphorical Wording	Congruent Wording	Process Type	Frequency in per Text
1	the Mars of our dreams	we have dreamed of Mars	mental	2
2	circular orbits	to orbit circularly	material	3
3	the density of the air	the air is dense and …	relational	1
4	might be artificial irrigation canals	might irrigate canals artificially	material	1
5	from previous experiments	that it was experimented previously	material	2
6	absoluteness of space	the space is absolute	relational	1
7	physical manifestation of a …	to manifest physically a	verbal	1
8	what that finding would mean	what they have found and what would it mean	material	2
9	and resembling our own	and it resembles our …	relational	1
10	making it much colder	it makes it much …	material	1
11	and spirituality	and to be spiritual	relational	1
12	colony collapse disorder	colony which is collapsed and disordered	material material	3 3
13	for pollination	to be pollinated	material	1
14	the presence of dozens of chemicals	that dozens of chemicals are present	relational	1
15	killing the parasite	how to kill the parasite	material	2
16	30 percent of the world's malaria infections	30 percent of people who are infected by malaria in …	material	1
17	even minor delays in the parasite's life cycle	even cyclic life of parasite might be delayed and	material material	1 3
18	fertility to a previously	to be fertile to …	relational	4
19	technique of testicular stem cell transplantation	to transplant testicular stem cell is a technique and	material	1

Unlike the commonsense language used for construing everyday life experiences, scientific language theorizes concrete life experiences into abstract entities, which can then be further examined and critiqued. Such theorizing involves turning processes into nouns (Halliday & Martin, 1993). In these texts, out of 257 process types, 152 processes are material, 77 are relational, 13 are mental, 15 are verbal, none are behavioral and existential. In the above Table (5 & 6), there are many processes rendered in nouns, that is, abstract entities such as *our dreams* (1), *hospitalizations* (18), *growing pains* (16) etc. these are now no longer describing actions; they are focused on objects or concepts.

Eggins (1994, as cited in Kazemian *et al.*, 2013) takes into account the fact that although substantially nominalized utterances can appear influential, impressive, academic and significant and may obscure the meaning, the true incentive for this grammatical process is a functional one: nominalization allows us to do things with the text that we cannot do in a non-nominalized text. Nominalization enables us to get rid of the dynamic and usually real word sequencing that goes with speaking, where we relate chains of actions in which we featured as actors. By nominalizing processes and reasonable connections, we can organize our text not in terms of ourselves, but in terms of ideas, reasons, causes, etc.

In each table, the probable congruent forms, types of processes and their frequency in per text both in scientific and political texts are represented. As it was mentioned formerly, GM instances in these texts serve several important functions as the following examples:

9.   **a.** The Centers for Disease **control** and **prevention** estimated in 2011 that the U.S. sees million **illnesses**, 128,000

     hospitalizations and 3,000 **deaths** every year from foodborne organisms (McKenna, 2012). (**GM**)

b. The centers to *control* and *prevent* disease has estimated in 2011 that the U.S sees millions of people who are *ill*, 128,000 who are *hospitalized* and 3,000 who *die* every year from foodborm organisms. (**Congruent**).

In the above examples, the processes (*hospitalized*, *die*, *control* and *prevent*) become nouns (*hospitalization*, *death*, *control* and *prevention*). It is worth noting that nominalization, as a form of GM, allows a large amount of information to be packed into a comparatively small space (such as, a noun group). This has the effect of *condensing* information within the sentence; it contributes to *language economy*. Besides, texts with normal quantity of metaphoric instances add more beauty and clarity to the texts.

Frequency of IGM Instances in Scientific and Political Texts

The frequency of process types in both of the genres are represented in tables 7 and 8 and their following graphs as follows:

Table 7: Frequency & Percentage of Process Types in Scientific Texts

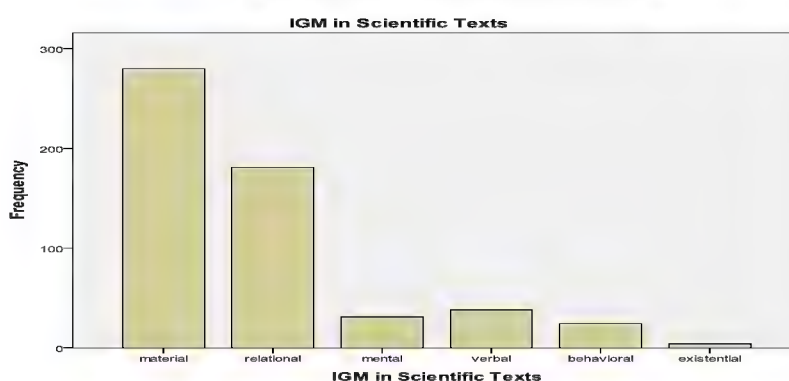| Process Types		Frequency	Percent
Valid	material	286	50.2
	relational	165	32.4
	mental	39	5.6
	verbal	39	6.8
	behavioral	15	4.3
	existential	4	.7
	Total	**548**	**100.0**

Figure 1: Frequency of Process Types in Scientific Texts

The above table and figure display the frequency of IGM in scientific texts. 548 instances of IGM were extracted from ten scientific texts. 286 material, 165 relational, 39 mental, 39 verbal, 15 behavioural, 4 existential process types out of 558 were obtained. The scientific texts represent the dominant textual forces of material and relational process types than any other types.

Table 8: Frequency & Percentage of Process Types in Political Texts

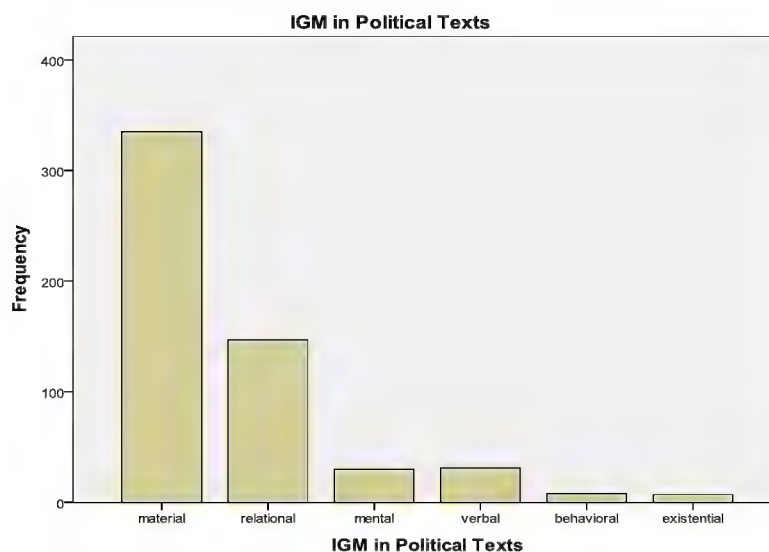| Process Types		Frequency	Percent
Valid	material	335	60.0
	relational	142	26.3
	mental	29	5.4
	verbal	39	5.6
	behavioral	4	1.4
	existential	7	1.3
	Total	**556**	**100.0**

Figure 2: Frequency of Process Types in Political Texts

556 instances of IGM were extracted from political texts. Out of this number, 335 of them have material processes, 142 of them relational, 29 (mental), 39 (verbal), 4 (behavioral) and 7 of them are existential. Like scientific texts, political texts represent the dominant textual forces of material and relational process types. This means that in the world of politics and science some events or actions are prevalent.

DISCUSSIONS AND IMPLICATIONS

With reference to the research questions raised in the study, the discussion of the findings is represented as follows: a rather vivid expectation that was construed by the analysis of congruent wording of scientific and political texts was the higher frequency and dominant textual forces of material and relational process types and low frequency of other types. Comparing metaphorical and congruent wording in political and scientific texts represents that metaphorical domain elaborates the situation in a more fascinating, energetic, colorful, vivid, academic and desirable manner. IGM instances in both genres serve several important functions like condensing, compacting, beautifying, and creating technical terms as well.

IGM instances in scientific texts are used to create technical and scientific terms or new entities, to establish cause-and-effect relationships between various phenomena, to systematize previously stated information and are also utilized for reasoning and expanding the smooth flow of the text and invite the reader to make sense of a world structure which is tidily, carefully layered and promising in some way; it has a high density of information as well.

If we compare the metaphorical and congruent domain in the this study, we will see that GM's role is fundamental in political and scientific contexts and without it, these discourses will fall short of accomplishing, transmitting and implementing their power-oriented, discursive applications and intended attitudes. Simon-Vandenbergen et al. (2003) discuss that nominalization, for instance, can be readily seen as a means of showing that you have gained mastery over a discipline and you have therefore appropriated some power for yourself. Nominalization is a technique for taking a chunk of information, or even large body of knowledge, that you assume will be shared by your reader, and referring to it by a kind of shorthand. It shows that you and the reader belong to the same in-group- but it can also exclude those who don't belong to the in-group. Nominalization can be used as a device to show that the writer has power over the reader, and also as a device to exclude all those who are not experts or at least aspiring experts.

First and foremost, one of the principal pedagogical implications of the present study and studies of the same essence is to pave the way and provide a tool and insight for academic writings and those who are inclined to seek IGM in their professions as scientific and political writers, instructors, translators and students. Afterwards, many academic students may need the opportunity to pursue and learn how to read the political and scientific register, so that they might effectively take part in the political and scientific processes that these genres are applied for. Thereafter, texts with a high degree of GM are regarded preeminent, distinguished, academic and formal in English contexts, as they are in other language contexts. GM, particularly nominalization, is a typical characteristic of many sorts of academic texts and is generally accompanied by the notions of *objectification, conceptualization* and *distance* in the humanities, politics and other sciences and with *technicality* and *rationality* in scientific register as well. Thus, learning GM and IGM is an efficient way for EFL and academic students to significantly and dramatically develop their writnig and reading. In addition, learning and knowing about GM and IGM can also smooth the path for the fluent and accurate process of translation to some extent, because translation process necessitates students to possess high language ability and distinctive command of English, primarily GM and IGM. Last but not least, IGM assists academic students and writers to dramatically reduce the number of clauses in their writing and condense more information into each nominal group. As a result, it grants outstanding beauty to clauses and engrosses the reader's attention to pursue the writing.

CONCLUSIONS

This study investigated a particular lexico-grammatical resource, the resource that SFL refers to as IGM. Expanded and initiated primarily by Halliday (1985,1994), the essence of GM demonstrates a novel and innovative contribution that identifies and explains the fact that nearly all genres, in particular, political, scientific and academic registers in writing are functionally aimed at achieving *objectification*, *conceptualization* and *abstraction* of their content. They accomplish this functional objective through the linguistic means of GM and IGM respectively. The predominant lexico-grammatical feature in all academic writing, in particular, in political and scientific texts of the study is the extensive and elaborate use of the nominal group, represented by nominalization. Considered as the important properties of written English, GMs are generated through the grammatical operation of *derivation,* i.e. establishment of new words by adding affixes, in short, a verb or an adjective is transformed into a noun by attaching endings to them. Accordingly, the writing gives every indication of being more compact, abstract, academic and more formal.

In this research, the IGM framework was used to carry out an analysis on 10 political and 10 scientific texts and also to pinpoint their similarities and dissimilarities based on nominalization and process types. As it was shown, the primary function of nominalization is to *dismiss actors or doers*, as it were. The removal allows different implications of this particular IGM as follows: actors are no longer readily recognizable, they play a slight role, they are peripheral for the case at hand, the writer is incapable or reluctant to identify them or, coming from the other side, the outcome of an action is more preeminent than the action itself. Thus, the focal point of nominalization as an IGM is that it turns processes and qualities into things, therefore nominalizations give existence to *things*; in particular, they construct conceptual objects.

The main objective of this research was to discover similarities and discrepancies of both genres based on nominalization and process types. After analyzing metaphoric words and rendering them into congruent domain to distinguish the process types, the present study indicated that IGM has dominated political and scientific texts to some extent. The analysis of the data showed that although the frequency of the IGMs in both genres is approximately the same but *material* process type which is based on action and doing is utilized partly more in political discourse than scientific

one (286 material processes for science and 335 for politics) and it is probably because of the fact that political texts deal more with provoking, persuading and convincing people for and/or against a particular party or group and it requires more action words than scientific texts The analysis also revealed that the second dominant process type in both is *relational* which is based on being and having (165 in science and 142 in politics). The theoretical model of Halliday and Matthiessen (1999) which investigates transitivity as a means of depicting inner and outer world experiences is applied in the analysis. In both registers, the function of utilizing IGM is to express the lexis and grammar in the way the speaker or the writer wants in order to create or notify a certain influence on his/her reader or audience. In each text, the aim is transference of the intended meaning to the reader or the audience in a bright, appealing and magnificent way. In scientific, this is done by several important functions like encapsulating, compacting and creating technical, expert and professional terms that are obtainable to a nimble and conscious mind. In spite of all the above functions, the aim of the speaker or the political writer is to convey the intended message, prevail, persuade and provoke a particular group and carry up the job of initiating the reader or the audience into certain worldview in a quick, compact, arousing and desirable manner.

Finally, It was detected that the existence of IGM heavily in per text boosts the general load of information the clause or the utterance expresses: the more the number of embodied IGMs in a text, the greater the lexical density, information load, conceptualization, abstraction, and of course ambiguity represented by the text. Thus GMs are of paramount importance, perfect for the political and scientific discourses which invest high quality on the transference of information in an economical and condensed way. The present study has been limited to fairly small scopes; however, the phenomenon of GM proved to open new possibilities for investigating them in other types of discourses and with more numbers of texts.

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